Spatial Analysis of West Nile Virus in Maryland, 2000-2005

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Overview

- Goals
- Background on West Nile Virus (WNV)
- Maryland WNV Results- Spatial Analysis and Indicators of Human Disease
- Discussion and Public Health Impact
- Limitations
- Future Questions

Project Goals

- Complete 2004 annual arbovirus report
- Describe experience of WNV in Maryland and do preliminary analysis:
  - Map location of positive mosquito pools and human disease.
  - Detect clusters of human cases.
  - Explore indicators of human disease.

WNV Background

- Agent: arbovirus
- Vector: mosquito (multiple species can carry WNV; such as *Culex spp.)*
- Reservoir host: avian
- Emerging disease: First seen in U.S. in 1999
- Maryland:
  - First detected in dead crow in 1999 (Baltimore City)
  - First human case in 2001

Maryland Agency Acronyms

- DHMH = Maryland Department of Health and Mental Hygiene
  - CVPH= Center for Veterinary Public Heatlh
- MDA = Maryland Department of Agriculture
- DNR = Maryland Department of Natural Resources

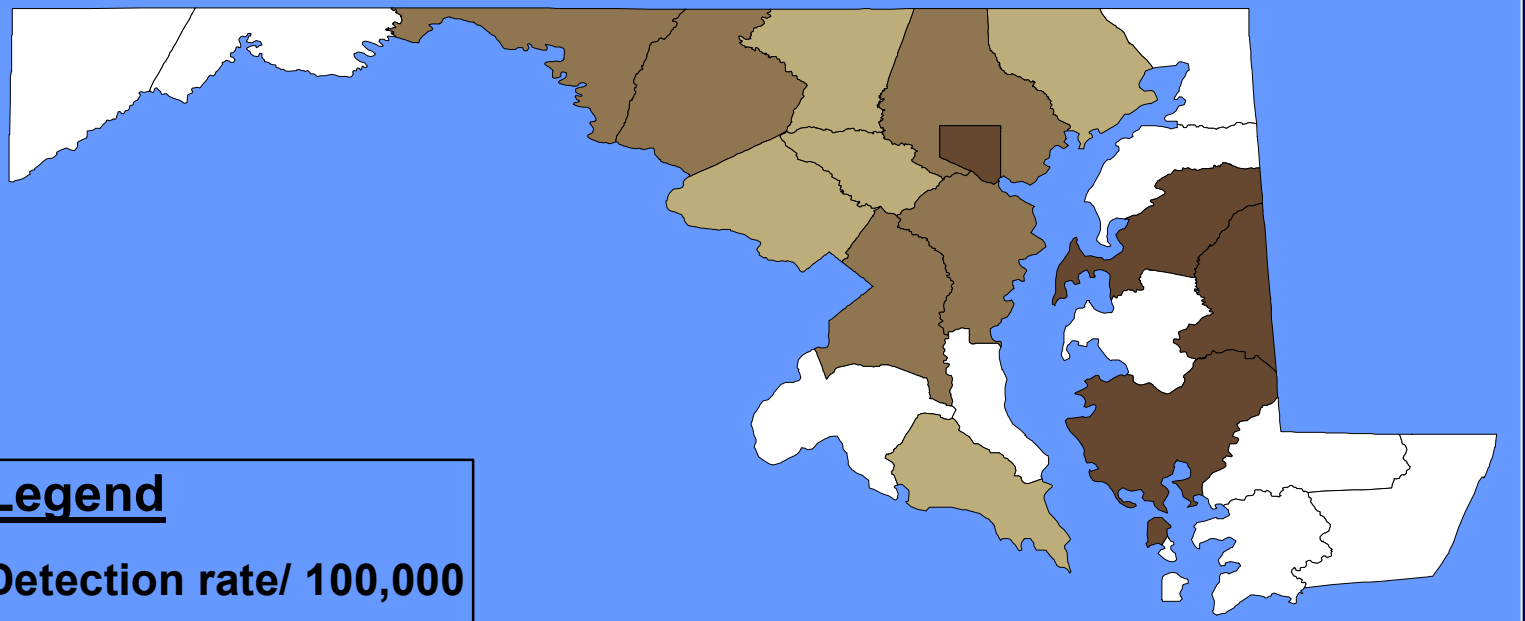
Maryland WNV Surveillance: A Multi-Agency Effort

- Human and Non-Human Surveillance
  - Enhanced Human Surveillance: DHMH
  - Equine & small mammal surveillance: DHMH/CVPH
  - Human Pesticide Illness Monitoring: DHMH Office of Environmental Health
- Mosquito surveillance (collection and speciation): MDA
- Mosquito control: MDA
- Wildlife: DNR (live birds and mammals)

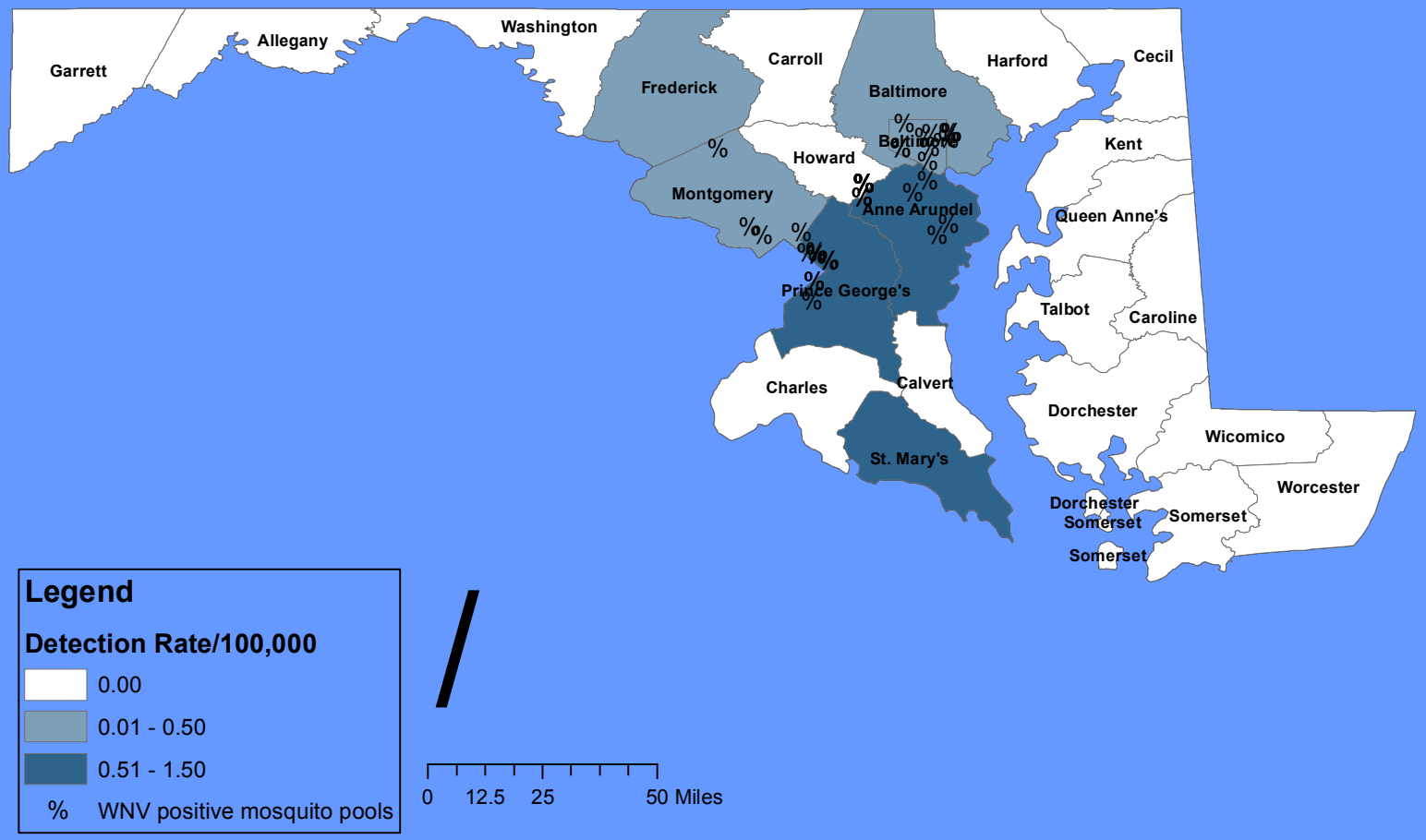
Human WNV Cases

- Case definition
  - West Nile encephalitis
  - West Nile aseptic meningitis
  - West Nile Fever
- Reported cases in Maryland
  - 136 total (90 severe)
  - Peak: 73 cases in 2003
  - Most recent year: 5 in 2005

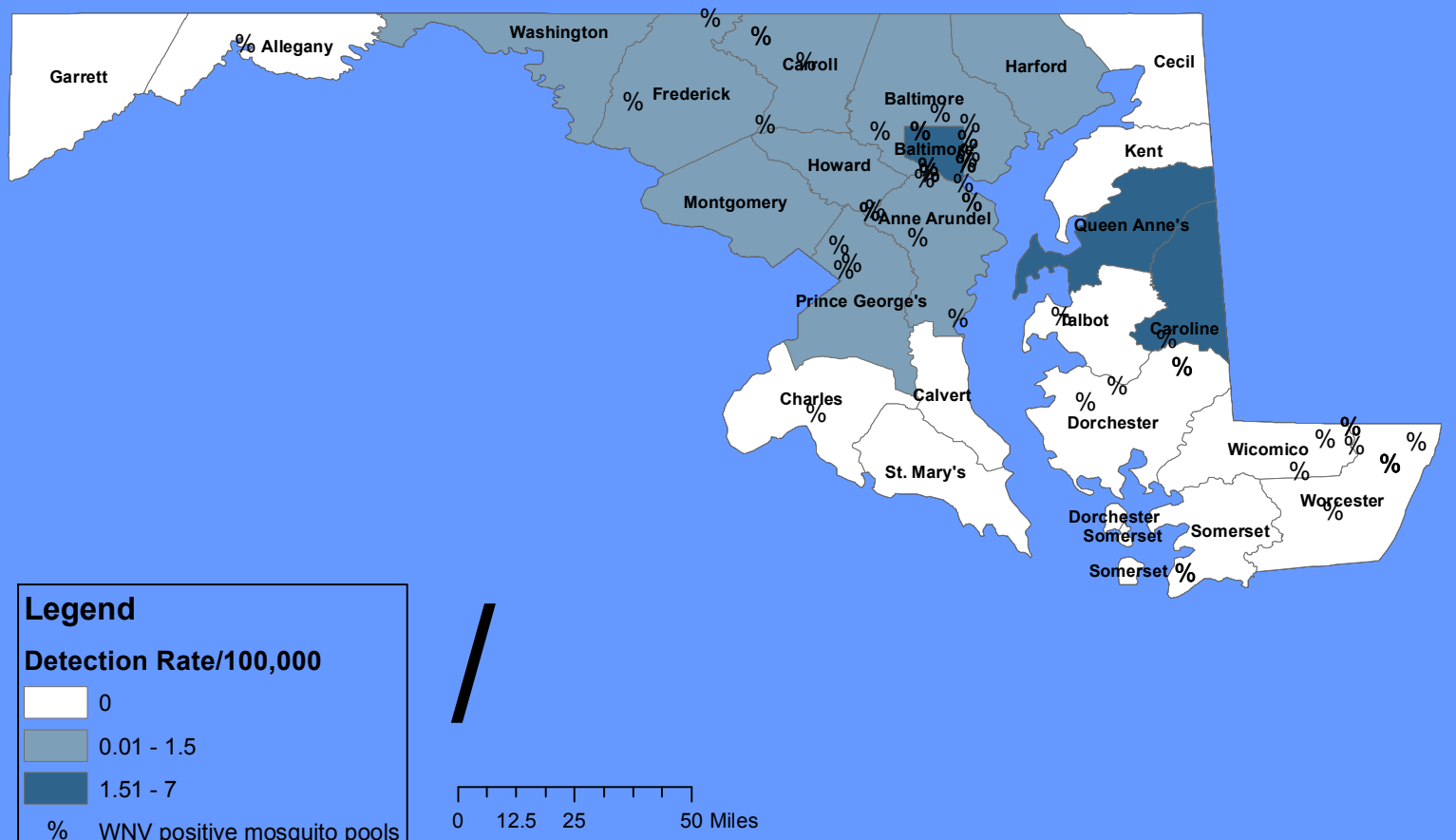
Overall Incidence Rate, Severe WNV Disease
Maryland 2001-2005



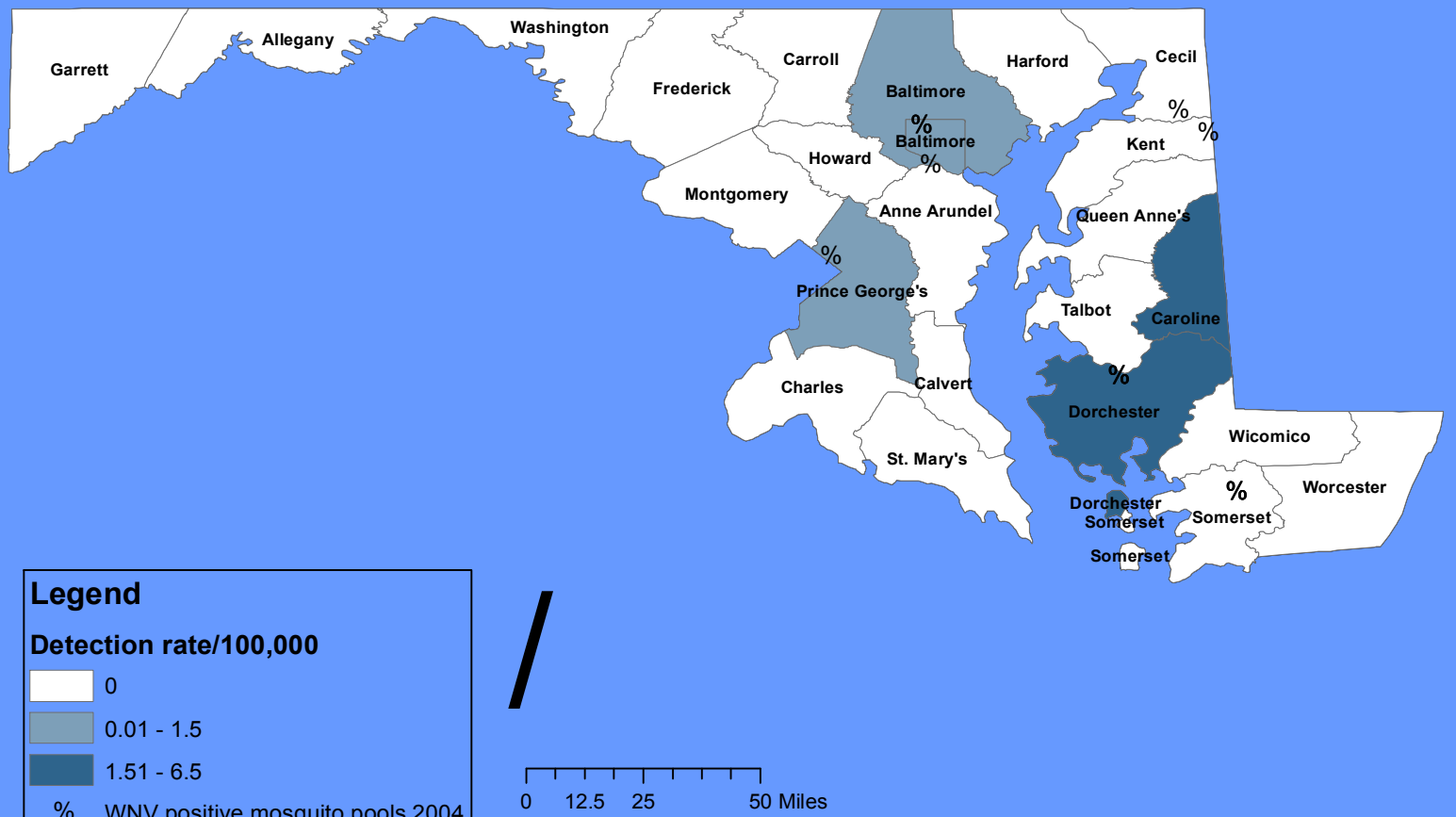
Severe WNV Human Incidence Rates and Positive Mosquito Pools, 2002



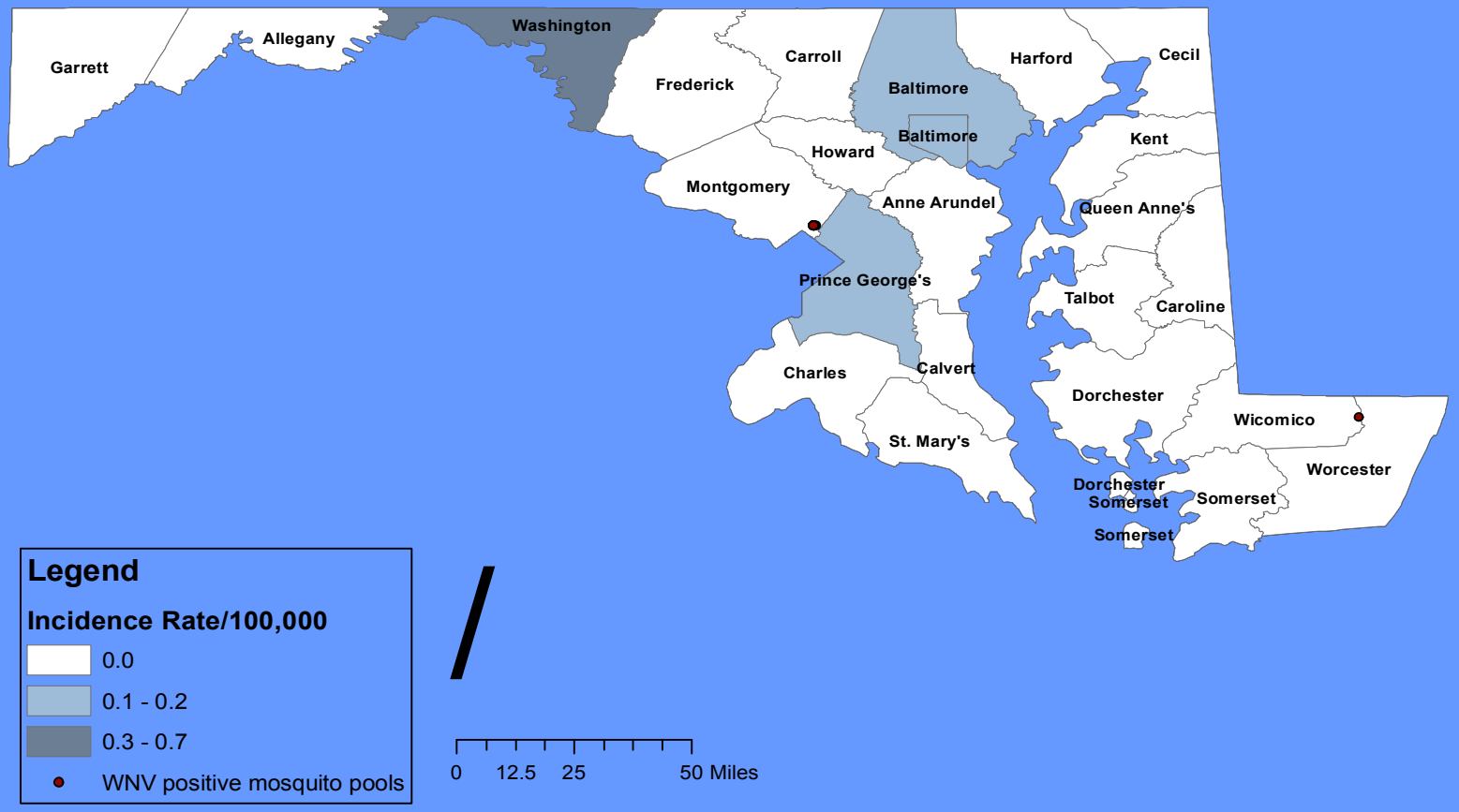
Severe WNV Human Incidence Rates and Positive Mosquito Pools, 2003



Severe WNV Human Incidence Rates and Positive Mosquito Pools, 2004



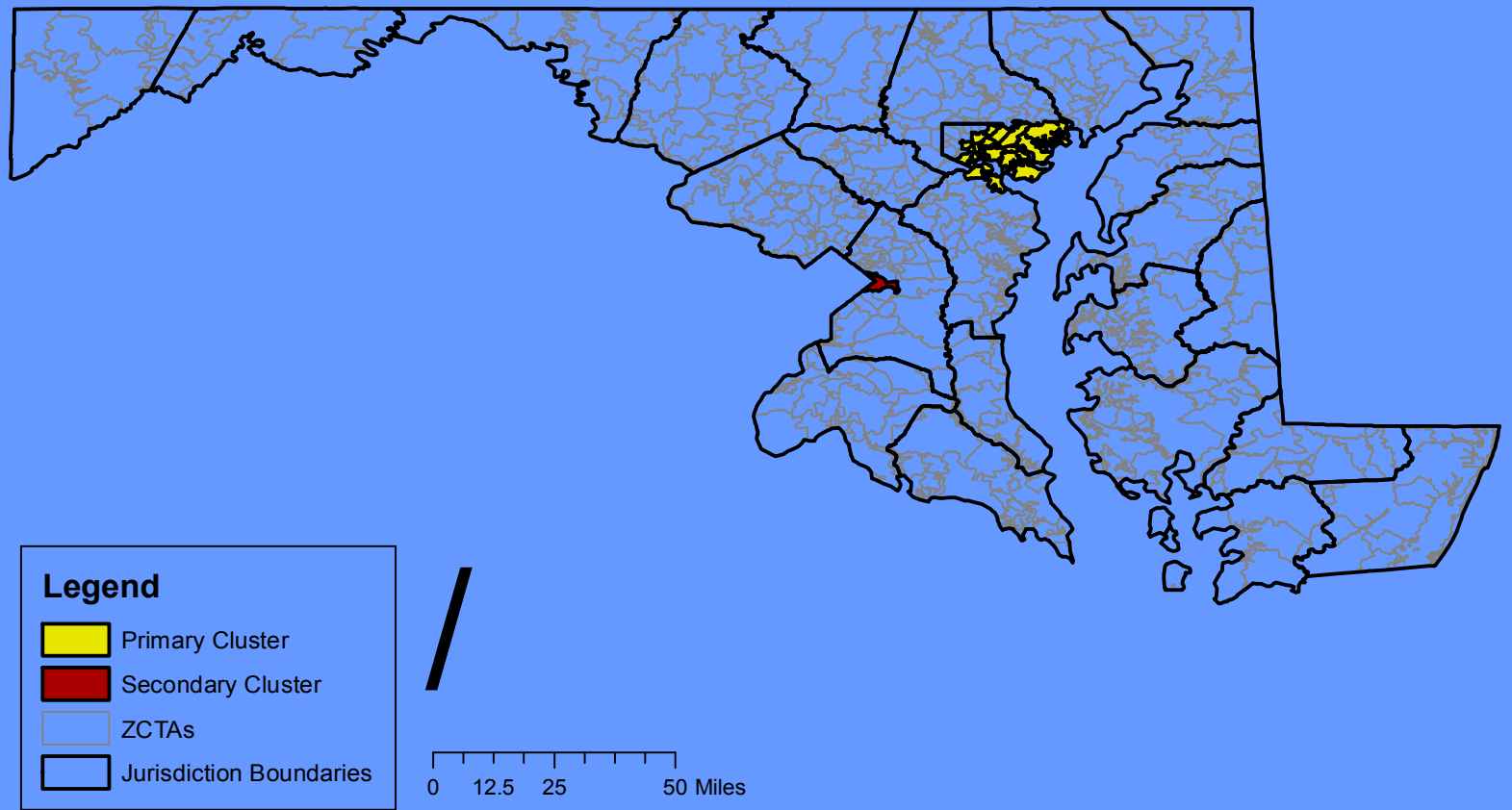
Severe WNV Human Incidence Rates and Positive Mosquito Pools, 2005



Cluster Analysis

- Method: Cluster scan analysis (Poisson model) of incidence rates by ZCTA's.
- Results:
  - Primary cluster in Baltimore City/County (12 km diameter), p=.001
  - One secondary cluster in Prince George's County (1 ZCTA), p=.067

Maryland ZCTAs and Hot Spots for Severe WNV Disease Based on Cluster Scan Analysis



Indicator Variables

- Determine if correlated with incidence of severe WNV disease by jurisdiction:
  - Surveillance indicators
    - Mosquito detection (any)
    - Years in which WNV-positive mosquitoes reported
    - % dead crows identified in 2002
  - Demographic indicators
    - % population >50 years of age
    - Population density

Categorical Univariate Results

	Jurisdictions with Severe Disease (n=14)	Jurisdictions with no Severe Disease (n=10)	p-value (Fisher's Exact)
WNV+ Mosquito pool (any year)	11 (85%)	8 (80%)	1
>1 year with + mosquito pool	8 (62%)	2 (20%)	0.22
>2.3% of dead crows 2002	**10 (71%)**	**2 (20%)**	**0.04**
>28% of population >50	5 (36%)	7 (70%)	0.21
Population density > 300 people/sq mi.	**9 (64%)**	**1 (10%)**	**0.01**

Discussion

- Maps suggest early, sustained incidence in urban East-Central region and later higher incidence in Central Eastern Shore (nearly all resolved).
- Clusters detected in Baltimore City, Baltimore County, and Prince George's County
- Dead crows, population density were indicators of severe human WNV; mosquitoes detected almost everywhere

Limitations

- No control group for comparison (either spatial or individual)
- Passive surveillance
- Couldn’t obtain all surveillance data

Future Questions

- How good is the passive human surveillance?
- What are the effects of spraying and other mosquito control efforts on human WNV incidence?
- Temporality (testing result of cases or cases after positive mosquitoes detected)?
- Why do we see WNV-positive mosquitoes and no cases?